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Title Page

The effectiveness of trained volunteer delivered interventions in adults at risk of malnutrition: a systematic review and meta-analysis

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Abbreviations: ADLs, activities of daily living; NHS, National Health Service; PREMS, Patient reported experience measures; PROMS, Patient-reported outcome measures; QALYs, quality adjusted life years; QoL, quality of life; RCT, randomised controlled trials; ROB Cochrane Collaboration's Risk of Bias tool; UK, United Kingdom; US, United States

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Abstract

Malnutrition burden is high. Trained volunteers present a growing workforce in the NHS and are increasingly engaged in schemes that may be useful in tackling malnutrition in different settings. A recent systematic review of trained volunteers in a hospital setting reported improved patient satisfaction and some improvement in dietary intake of patients. This review explored the effectiveness of trained volunteers in delivering nutritional interventions in adults at risk of malnutrition in different care settings on patient-centred outcomes and aimed to identify and build an evidence base for a more defined role for trained volunteers in malnutrition prevention in the UK. Six electronic databases were searched to 30th October 2018. Abstracts and full texts of relevant studies of all study designs were screened by two authors independently. Studies were examined for risk of bias and overall quality of evidence of main outcomes was assessed using the GRADE approach. Narrative synthesis and meta-analyses (nutritional intake) were used to combine outcome data. Seventeen eligible studies were included. Three were conducted in the home setting and fourteen were hospital based. Low quality evidence from one small RCT showed significant improvements in physical performance and fear of falling resulting from a volunteer intervention in the home setting. Very low quality evidence from meta-analysis findings indicated that trained volunteer mealtime assistance significantly improved lunchtime energy intake but did not significantly improve daily total energy intake in hospitals. Very low quality evidence also suggested that volunteers improve patient experience and satisfaction and are safe. This paper identified some evidence to suggest trained volunteer interventions may be effective in improving some outcomes in nutritionally at-risk older adults in home and hospital settings. Considering the high prevalence and costs of malnutrition, adequately-powered research is needed in this area to identify the most effective use of resources.

25 **Keywords: Malnutrition, nutrition risk, volunteers, nutrition intervention, mealtime**
26 **assistance, supportive intervention**

1. Introduction

Malnutrition or undernutrition, characterized as “a state resulting from lack of intake or uptake of nutrition that leads to altered body composition (decreased fat free mass) and body cell mass leading to diminished physical and mental function and impaired clinical outcome from disease” (1).

is found in individuals of all ages, all care settings and all disease categories globally (2). It is estimated to affect 3 million people in the United Kingdom (UK), 93% of whom live in the community (3). In Europe a total of 33 million people are affected by malnutrition (4) and it is estimated to be responsible for 5.7 million lost life years and 9.1 million QALYs (quality adjusted life years) (5). In the United States (US), although data on state-level burden of community-based malnutrition is limited, one in three people have been found to be at risk of malnutrition in the hospital through nutritional screening (6). In Australia, the prevalence of malnutrition ranges from 20-50% in the acute setting and 10-30% in the community setting (7). Malnutrition adversely affects morbidity, mortality and quality of life (QoL) through delayed recovery and prolonged hospital stay, increased falls risk, frailty, reduced muscle strength and impaired activities of daily living (ADLs). The treatment cost of malnutrition is 3-4 times greater for an at risk or malnourished patient compared to a non-malnourished patient in England (2) and can be attributed to an additional cost of \$10.7 million per year in Australia (8). The total cost of managing malnutrition is estimated to be £19.6 billion in England (2), \$157 billion in the US (9) and €120 billion in Europe (10). Most costs are incurred in hospital settings where only 2% of malnourished subjects are found (2). Effective screening, prevention and treatment are essential across all settings to minimise complications and costs.

Malnutrition is caused by a range of different factors altering body composition, metabolism and biological function, with a lack of consensus on the diagnostic criteria (11, 12).

Immediate causes of malnutrition include acute and chronic diseases, which may be sub classified as disease or injury related malnutrition with inflammation (acute or chronic) or disease related malnutrition without inflammation (11, 12). Malnutrition or undernutrition without disease may also be a result of decreased nutrient intake due to hunger or socio-economic or psychological factors (12). Far harder to identify are the underlying causes which include social isolation, physical disability, problems accessing and cooking food, poverty or psychological health (13). It is not surprising therefore that the majority of malnutrition is harboured in the community among older people. The growing awareness of this issue has seen a rise in both clinical and social initiatives to tackle malnutrition (14). The use of volunteers is one such strategy which has become more widespread in recent years (14). With increasing pressures to improve quality and efficiency, volunteers present an opportunity to add value to the healthcare system.

The focus of this review is formal volunteering which involves training and recruitment through organisations in developed countries (15). In the US and Australia, national statistics have shown that approximately 30% of adults volunteer through a variety of volunteer organizations (16, 17). In England, around 3 million or more people, approximately 5% of total population, are estimated to volunteer regularly across health and social care settings recruited through voluntary organisations and the National Health Service (NHS). Currently there are plans to increase training and accreditation schemes to double the number of volunteers in the NHS (18, 19). This highlights the need to understand the depth and breadth of the services volunteers offer for more effective utilisation of resources.

Volunteers are engaged in multiple interventions that may impact malnutrition across different settings. They are used as mealtime assistants in institutional settings to alleviate

75 some of the time pressures and staff shortages which lead to deficiencies in the care of at risk
76 subjects and contribute significantly to malnutrition burden (20) (21). In hospitals, volunteers
77 are used to support patients in a variety of ways including assistance with completing menu
78 cards, preparation of meal trays, cleaning patients' hands, positioning the patient safely,
79 providing feeding assistance and encouragement, and promoting social interaction (22).
80 Volunteers are also increasingly being used in the community for social interventions
81 including community food projects such as escorted shopping service and lunch clubs,
82 befriending services, counselling and lifestyle advice, and recently in malnutrition screening
83 initiatives to help identify and support vulnerable people (23) (14). As volunteers are
84 continually in contact with at risk adults, they present an opportunity for early identification
85 and intervention to tackle malnutrition effectively across all settings. However, although
86 widely acknowledged to improve patient experience, there is currently a lack of scientific
87 evidence for the effectiveness of volunteer services in health and social care (15).

88 Previous systematic reviews (24, 25) reported mixed evidence that trained volunteers are
89 effective in improving the dietary intake of institutionalised patients. Volunteers were also
90 reported to improve patient and staff satisfaction of mealtime care but failure to consider the
91 validity of methods used to assess satisfaction limits the strength of this finding. In addition,
92 the inclusion of studies where the effect of volunteers on patient satisfaction was not reported
93 clearly (due to the use of co-interventions) may have influenced these findings. Another
94 review (26) reported mealtime interventions in hospitals were effective in improving dietary
95 intake of patients but included both paid staff and volunteer delivered interventions. Previous
96 reviews have included a heterogeneous group of both trained and untrained volunteers
97 delivering a range of interventions and targeting a range of underlying causes of malnutrition,
98 however, these have focused on institutionalised settings only. This systematic review aimed
99 to identify and broaden the evidence base for a more defined role for the growing trained

volunteer workforce across all healthcare and community settings, and to help target resources towards most effective interventions or settings for malnutrition prevention in the UK.

Aim:

To explore the effectiveness of volunteer delivered nutritional interventions in adults at risk of malnutrition in different settings on patient-centred outcomes.

2. Methods

A systematic review was undertaken guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses: the PRISMA Statement (27) and Cochrane guidelines (28). A protocol was developed and registered on PROSPERO (registration number: CRD42019118851).

Eligibility criteria

In order to capture a full picture of the effects of volunteer interventions on a wide range of outcomes, no restrictions were placed on study design. All randomised controlled trials (RCTs), non-RCTs, non-intervention and qualitative studies were included to allow realistic exploration of the healthcare environment where funding restrictions, ethical issues and other constraints make blinding and randomisation difficult.

Search strategy and study selection

Six electronic databases were searched to 30th October 2018: Ovid MEDLINE, Ovid Embase, Ovid PsycINFO, Web of Science (Core Collection), Cochrane Central Register of Controlled Trials and PubMed. A search strategy was developed to combine the key concepts describing the population and nutritional interventions: (1) volunteers, (2) nutritional interventions, and (3) adults either malnourished or at risk of malnutrition. Search terms were combined with

suggested MeSH terms wherever possible and further refined by excluding studies on obesity/overweight, animals, children, adolescents and artificial nutrition. No language or publication date restrictions were applied. Further relevant studies were identified by snowball searching where the reference lists of included studies were scanned for related citations. Additionally, each included study was opened up in PubMed and a search undertaken of all related citations.

Study screens for eligibility were carried out by two review authors independently (JL and MD) using the PICO format (**Table 1**). Duplicate studies were removed from all searches within the electronic databases wherever possible and imported into an EndNote X8 library for screening and further removal of duplicates. At the first screen, titles and abstracts of studies that met the inclusion criteria were identified (Table 1). Any studies deemed not to meet the inclusion criteria were excluded. Studies were excluded where interventions were based in economically less developed countries, or aimed specifically at comorbidities or healthy lifestyle, or did not report outcomes for volunteer interventions clearly when part of a co-intervention, or were not delivered by trained volunteers where informal volunteers helped care for friends or family, or were aimed at enteral/parenteral nutrition. Studies were also excluded if they did not include humans or where no outcomes of interest to the present review were reported. At the second screening, full texts of potentially eligible studies were retrieved and assessed against the inclusion criteria. The eligibility criteria were applied and reasons for exclusion noted. Any discrepancies were resolved by discussion with the two senior authors (CEW and CB).

Quality of evidence and risk of bias

Risk of bias was assessed independently by JL and MD using the Cochrane Collaboration's Risk of Bias tool (ROB) for RCTs ,the ROBINS-I tool for non-RCTS and observational

studies and modified CASP checklist for qualitative evidence from both qualitative and mixed methods studies. Any discrepancies were resolved by discussion with a third co-author. Judgements were summarised in a table and a positive (+), negative (-) or question mark (?) were used for each domain to denote high, low or unclear risk of bias. The overall quality of the body of evidence for each main quantitative outcome was assessed using the GRADE Working Group criteria according to Cochrane guidelines by JL and MD (29). Limitations in design and implementation, indirectness of evidence, unexplained heterogeneity or inconsistency, imprecision and publication bias were used to lower the quality. Any large magnitude or spurious effect from confounding and dose-response gradient were used to increase the quality level. The overall body of evidence was given a grading of very low, low, moderate or high for each outcome and displayed in a summary of findings table. The summary effect size for each outcome was derived from meta-analysis of findings wherever possible or based on any statistical significance reported by the relevant studies. Where a measure of statistical significance was unavailable, results were presented in a narrative format. Reasons for downgrading of quality of evidence were included in the footnotes.

Data synthesis and statistical analysis

Information on population, intervention, comparator, outcomes, setting, volunteer training and any additional outcomes was extracted and displayed in a characteristic of studies table by JL using a data extraction form and checked by MD. Preliminary synthesis involved grouping studies according to primary and secondary outcomes as per Cochrane guidelines (30) (31). Results were tabulated and synthesized either in narrative or where sufficiently similar outcome data were available for pooling, by meta-analysis. For all outcomes, trends in the data were described according to the number of studies reporting the outcome, setting,

methods, study design, methods of outcome reporting, and statistical significance of results ($p < 0.05$).

Nutritional intake was the only outcome identified where sufficient data were reported to allow a meta-analysis. Only final means and standard deviations were available. These were pooled in a meta-analysis with the use of Review Manager (RevMan version 5.3; Nordic Cochrane Centre) in a continuous, inverse variance, random effects analysis. Mean differences were used as all the studies reported data on a similar scale (energy in Kilocalories or Kilojoule) while a random effects model accounted for the variability in study designs and participants (32). Energy data were all converted to kilocalories to allow pooling. Heterogeneity was assessed by measuring the inconsistency (I^2) statistic based on the chi-squared test (χ^2 , or Chi^2). Inconsistency across studies was classified as follows: I^2 40% - low; 30 - 60% - moderate; 50 - 90% - Substantial; 75 - 100% - Considerable. If heterogeneity was $< 50\%$ (at a statistical significance of $p = 0.1$, as per Cochrane guidelines), a meta-analysis was undertaken.

3. Results

A total of 11,143 studies were identified. After removal of duplicates, the titles and abstracts of 8533 titles were scanned for eligibility. Full text articles were obtained for a total of 114 studies of which 17 were selected for inclusion in the review (**Figure 1**).

Preliminary synthesis

Seventeen eligible studies were included in this review and all included trained volunteers (**Table 2**). Seven studies were based in the UK, four in Australia, two in USA, one each in Austria, Canada, the Republic of Ireland and New Zealand. All participants were older adults over 65 years with mean age 74 to 89 years in studies that reported mean age. Three studies were based in the home setting ($n = 209$ participants), of which one study had four subsequent studies from the same cohort (33-37). Fourteen studies were hospital based

(quantitative outcomes: n = 591 participants; qualitative outcomes: n = 146 participants; two studies did not specify These sample sizes). Participants differed widely in terms of nutritional status, with eight out of the 17 studies reporting nutritional status using different methods prior to the intervention. Five studies assessed participant nutritional status using the Mini Nutritional Assessment (MNA) screening tool (33, 38-41) and two studies used the Malnutrition Universal Screening Tool (MUST) (22, 42). Among the studies reporting participants as 'at risk of malnutrition' or malnourished, this ranged from 20%-88% (22, 33, 38, 39, 42, 43). One study measured nutritional status using Body Mass Index (BMI) only (41), with 20-25% of participants reported as undernourished ($\text{BMI} < 18.5 \text{ kg/m}^2$), table 2. The remainder of studies did not report nutritional status.

Among the three home-based studies, two were RCTs. Both used convenience samples ranging from 80-100 and included older volunteers (>50 years) matched with participants on age, gender and location. Reasons for support included frailty, malnutrition risk, social isolation or access to food (problems with ADLs). One RCT (33) assessed the implementation of physical exercise and nutrition education by volunteers compared to a control group who received social support only from volunteers for three months. The other RCT (38) used volunteers to help with meal preparation while the control group received only a nutrition advice guidebook for one month. The third study (44) was a feasibility study where volunteers were trained to do nutritional screening and give nutritional education.

The remaining 14 studies were all based in hospitals and were of varied design. Volunteers assisted with mealtimes including feeding patients, opening packets, socialising and providing encouragement. Reasons for volunteer support ranged from dysphagia, cognitive impairment, nutritionally compromised, anorexia, or frailty to general help on geriatric ward.

Six were non-RCTs of which three used patients as own controls (39, 43, 45) two used matched controls (42, 46) while one used controls from a previous phase of intervention (40). One study was an observational pre-post design and used historical controls (47). Three were project evaluations (48-50) without controls. Two were feasibility studies without controls (22, 51). Two studies were qualitative (41, 52) one of which (41) used parallel controls. Sample sizes varied from 8 to 407, to unspecified number of participants and included patients, volunteers and staff. Length of intervention and follow up also varied considerably from 2 days to 3 months whilst study duration varied from 2 to 39 months.

Quality of studies

Risk of bias was mostly assessed for whole studies (**Figure 2**). For the three feasibility studies (22, 44, 51), risk of bias was only assessed for outcomes of interest such as patient experience, satisfaction and cost analysis. For mixed method studies (22, 43, 51) risk was assessed for both quantitative and qualitative outcomes separately using the relevant ROB tools as displayed in figure 2. Insufficient information on any objective or subjective outcomes led to unclear risk of bias judgement. Risk of detection bias was judged to be low for objective measures. The two RCTs (33, 38) were judged to be at low risk of selection bias but at high risk of performance bias due to non-blinding. One (38) was at unclear risk of reporting bias due to differences between reported outcomes and those in protocol. The other study (33) was found to be at unclear risk of detection bias due to non-blinding during collection of outcome data for subjective measures, and at high risk of reporting bias due to selective reporting (multiple functional outcomes, each reported in different publications). Most other studies were at unclear or low risk of selection bias but at unclear or high risk of detection bias where details on subjective measures were insufficiently reported. Missing information and an unclear risk of reporting bias due to a missing protocol contributed to an overall unclear risk of reporting and attrition bias in most studies. Similarly, most studies

were at high or unclear risk of confounding due to insufficient information, not controlling for assistance from visitors or family or changes in hospital menu over the long term, or inappropriate or no controls. Qualitative outcomes reported by mixed methods study designs (experience or satisfaction) were judged to be at unclear or high risk for most domains (22, 43, 51) due to insufficient information or lack of rigour on research design, methodology, and participant recruitment, and data collection and analysis. All studies were at high risk of bias for the domain considering the relationship between the participants and the researcher. The qualitative studies (41, 52) were judged to be at unclear risk of bias for some domains due to insufficient information within the data collection and participant recruitment methods and a lack of rigour in the overall data analysis. Both studies had a low risk of bias for addressing the study aims, the appropriateness of the qualitative methodology and research design.

Effectiveness of volunteers: primary outcome assessment

Functional outcomes

Two of 17 (12%) of studies (n= 180 participants) which were home-based RCTs (33, 35, 38), reported on a range of functional outcomes (**Table 3**). One RCT reported on six functional outcomes. These outcomes were reported in five separate publications (33-37). The other RCT reported data on one functional outcome (38). Validated methods were used for all the measures; physical activity, fear of falling and self-efficacy were self-reported, frailty was partly self-reported and physical performance was measured using objective methods. There were significant improvements in lower limb muscle strength and overall physical performance, physical activity, and fear of falling in the groups receiving volunteer interventions compared to controls (low quality evidence). Improvements to self-efficacy were similar in both intervention and control groups (very low quality evidence). Similarly,

improvements to gait speed and balance, handgrip strength and frailty were similar in both intervention and control groups (low quality evidence).

Quality of life

One of 17 (6%) studies (n = 80 participants) which was home-based measured this outcome (36) (Table 3). Volunteer intervention was associated with significant improvements in the past, present and future activities domain compared with the control group (low quality evidence). However, improvements in overall QoL were similar in both groups (low quality evidence).

Patient, staff, and carer experience and satisfaction

Twelve of 17 (71%) studies (n = 297 participants from 8 studies, 4 studies did not report sample size), reported on patient, staff, and/or carer experience and satisfaction, including two home-based and nine hospital based summarized in **Table 4**. All studies used different methods for data collection ranging from observations (43, 45, 49, 52), semi-structured interviews and focus groups (22, 41, 51, 52), validated questionnaire (38) and an unclear methodology (44, 46, 48, 50). Methods used to process data in qualitative studies included an ethnographic approach (52) and thematic synthesis (41). Studies reported on aspects related to patient/staff experience or satisfaction. In the hospital setting, volunteers were valued by the patients, were viewed as proactive and helpful by staff in improving mealtime care of patients and spent longer with patients than staff (very low quality evidence). In the home setting they were found to be knowledgeable, useful and competent (very low quality evidence).

Adherence and retention

Four of 17 (24%) of studies (n = 142 participants from 3 studies, 1 study did not report sample size) reported data on the adherence and retention of the intervention program. One

home-based study (33) reported seven of 80 (8.8%) subjects replaced their buddies due to illness of buddy and failure to harmonize. The retention rates of volunteers reported by two hospital studies (22, 51) ranged from 49% to 76% from initial training to commencing and continuing volunteering. One did not report retention rates according to age but found older female volunteers (50-60 years), retired or working part time or with some experience to be most helpful in delivering the intervention based on the amount of mealtime assistance provided (51). The other study found volunteers aged <25 years were significantly more likely than older volunteers to leave due to moving away and studying commitments and less likely to leave due to work commitments and changes to the ward environment (22). One study noted no incidents of patients refusing to be fed by volunteers (22). One study (48) reported holding regular programme training, current waiting list and the continued support of some of the volunteers. The importance of dedicated staff including management towards recruitment and training, ongoing support from nursing, therapy team, dietitians and senior nurses as well as the value of the volunteers was highlighted in several studies described in Table 2.

Effectiveness of volunteers: secondary outcome assessment

Nutritional intake

Nine of seventeen (53%) of studies (n = 691 participants from 8 studies; 1 study did not report a sample size) reported energy intake (Supplemental Table 1), including one home-based and eight studies in hospital. In the home-based study (38), data on intake were collected using two 24-hour dietary recalls per assessment and averaged. From the hospital studies, five studied the effect of volunteer assistance at lunchtime only (39, 40, 42, 43, 45), one (46) described volunteers helping at 'each meal' and one (47) reported volunteers assisted between 10am-4pm. One study mentioned the availability of volunteers on the ward to feed patients for the first time during lunch and did not provide further details (48). The

studies differed in methods of estimating food intake which ranged from visual estimation (39), percentage intake (46), weighed plate waste (42, 43, 45), standardised food charts (47) to unspecified methods (40).

Four studies provided sufficiently comparable data on energy intake to allow pooling for meta-analysis. Meta-analysis (**Figure 3**) across the four studies showed no significant difference in total energy intake as a result of volunteer assistance (very low quality evidence): mean difference (MD): 292.54 Kcal (95% confidence interval (CI): 441.10, 1026.18); $p = 0.43$. However, heterogeneity was high ($I^2=72\%$). One study with significant baseline differences between intervention and control groups in the level of assistance provided and with borderline significant differences in weight was removed from the analysis (47). Removal of this study reduced the I^2 to 0%, and there remained no significant differences in energy intake between groups. Meta-analysis across three studies showed a significant improvement in lunchtime energy intake when volunteers were assisting (very low quality evidence); MD: 378.15Kcal (95% CI: 20.57, 735.72); $P = 0.04$, with no heterogeneity ($I^2=0\%$).

The data from the remaining five studies were not amenable to meta-analysis due to missing information or differences in outcome reporting. Two studies showed no difference in daily energy intake compared to controls as a result of volunteer assistance (38, 42), one showed a significant improvement in intake compared to controls (46), whilst one study did not report quantitative data but observed ‘previously reluctant eaters had eaten well and appeared to have benefited from the extra time and attention that they received’ when the volunteers were present (48). One study (40) reported volunteer feeding resulted in a significant increase in intake per patient .

Nutritional status

Three of 17 (18%) of studies (n = 110 participants from 2 studies; one study did not report a sample size) reported on different aspects of nutritional status (Supplemental Table 2). A home-based study (33, 34, 37) looked at malnutrition and changes in lean body mass, skeletal muscle mass, and inflammatory markers between intervention and control groups. A significant reduction in CRP (C-reactive protein) levels was observed for the intervention group compared to the controls (very low quality evidence) (intervention – MD: 0.08 (95% CI: -0.16, 0.32); control - MD: 0.46 (95% CI: 0.07, 0.85); $p = 0.040$). No significant differences were found between the intervention and the control group for any other outcome (low quality evidence). Among the two hospital studies, one study (40) reported a significant improvement in mean BMI (very low quality evidence) (MD: 0.37 Kg/m²; $p = <0.04$) of the seven patients assisted by volunteers during phase 3 of a 4-phase intervention, whereas mean BMI decreased significantly (MD: 0.6 Kg/m²; $p = <0.001$) during the control phase. The patients in the observation phase (phase 1) served as controls. No significant changes in mid-arm circumference were detected after the intervention (very low quality evidence), additionally there was no control in this study for this outcome measure. One study (48) recorded a reduction in the number of patients who were at medium or high risk of malnutrition (measured using the Malnutrition Universal Screening Tool (MUST)) after the volunteer intervention, but no quantitative data were provided.

Reliability

Reliability in the present review was used as an outcome measure to describe the volunteer ability to perform tasks effectively and to show initiative. Six of 17 (35%) of studies (n = 645 participants from 5 studies: 1 study did not report a sample size) reported different aspects of the reliability of the volunteer delivered intervention. From the home-based studies, one (44) tested the feasibility of training volunteers to screen for malnutrition and reported 80% agreement in nutrition screening items between volunteers and dietitians and

recommended enhanced training. Additionally, a home-based RCT (33) found the improvement in physical performance of the intervention group comparable to effects obtained by strength training guided by health-care professionals. Four hospital studies (42, 46, 50, 52) reported volunteers as proactive in assisting staff during food service, with patient communication, applying information learnt during training, in reporting missed meals or food items, ordering suitable alternatives and comparable to healthcare professionals for provision of service and delivering interventions.

Cost-analysis outcomes

Two of 17 (12%) of hospital-based studies (n = 24 participants from 1 study; 1 study did not report a sample size) reported different cost-analysis outcomes without considering effectiveness (very low quality evidence). One (49) reported an average estimated saving of \$11.94 - \$26.00 per encounter (based on the number of tasks and the average time spent) had the service been provided by paid staff. One study (22) estimated potential savings of \$34.98-\$58.27/patient/day above the training costs of volunteers

Patient safety

Five of 17 (29% of studies (n = 188 participants from 4 studies: 1 study did not report a sample size) reported on patient safety through measurement of the number of adverse events (very low quality evidence). One home-based study (33) reported four adverse events (two participants died and two interrupted the study for medical reasons) not caused by the intervention. Four hospital studies (22, 47, 49, 51) reported no adverse patient events associated with volunteer assistance.

1. Discussion

This review collated evidence on the effectiveness of volunteer delivered interventions on outcome measures in nutritionally at-risk populations in different settings with a view to identifying a more defined role for this growing ‘workforce’ in the UK. Volunteers were

found to be engaged in delivering different initiatives in nutritionally vulnerable older adults in homebased and hospital settings. In hospitals, volunteers were mainly engaged in mealtime assistance, while in home settings volunteers delivered physical exercise, nutrition advice, mealtime help and social support. Low quality evidence from one small home-based RCT (n = 80) suggests that volunteer interventions improve physical performance and fear of falling but do not differ from usual care in effects on handgrip strength, nutritional status or overall QoL. Very low quality evidence from small hospital studies indicates that trained volunteer interventions result in improved nutritional intake. Very low quality evidence suggests volunteer interventions improve patient experience and satisfaction and are safe in both settings. Effects on self-efficacy, BMI, mid-arm circumference and inflammatory markers were not assessed due to various limitations in study designs (Table 5).

Home setting

To our knowledge this is the first review to report on volunteer interventions in at risk or malnourished adults in the community. Evidence from observational studies supports the positive findings on functional outcomes in that these studies also found peer-led volunteers to be effective in reducing falls risk in older adults (53-55). The theoretical base underpinning the use of peer or age matched volunteers (used in the two homebased RCTs) states that advice is more readily accepted from contemporaries (56). Functional status is linked to nutritional status and QoL (13). However, in the present review the lack of effect on handgrip strength, nutritional and QoL outcomes may be explained by the small sample size and the use of social support as a comparator in the single RCT that reported data on these outcomes (33). Social support independently has been found to affect improvements in functional ability in older adults (57). As volunteers (lay buddies) also delivered the control, this raises further questions about which intervention is most cost-effective and if there is a need to provide an adjunct intervention to social support. Additionally, the combined exercise

and nutrition advice intervention in this study meant it was not possible to isolate the independent effects of each. Nutritional screening showed high agreement between volunteers and professionals in one study (44). It may be that nutritional screening combined with social support is sufficient to allow the much needed early identification and prevention of malnutrition in the community. However, confidence in these findings is limited as they come from single small studies, all of which reported different outcomes.

Hospital setting

Previous reviews reported lack of consistency in improved intake following volunteer mealtime assistance in hospitals (24, 25). Meta-analyses performed in the present review revealed a statistically significant improvement in lunchtime energy intake and a greater but non-significant improvement in daily energy intake when volunteers were present. Interestingly, the improvement in lunchtime energy intake coincides with findings that most studies (11 out of 14) reported volunteer assistance at lunchtimes. The results for total energy intake may have failed to reach statistical significance for a number of reasons including the small number of included studies, small sample sizes, variation in methods of data collection, varied nutritional content of food as well as the possibility that looking at total intake may mask the true effect of volunteers if patients compensated by eating less at other mealtimes when assistance was not available.

Evidence suggests targeted assistance results in higher intake (47). The five studies that reported improvement in intake all targeted volunteer assistance at patients who required specific help (dysphagia, unable to feed themselves). In contrast, the study (Roberts et al., 2017) that did not find a difference used volunteers for more general support while most patients were also at relatively lower risk of malnutrition. Wright et al (47) combined targeted assistance with the use of volunteers for relatively longer duration each day

compared to other studies (08.00–16.00h to assist during breakfast, lunch and snacks and supplements). The volunteers were also trained during a week-long training schedule which was also relatively longer than the other studies. They reported the greatest differences in intake between the intervention and the control groups favouring volunteer assistance. However, this study was at high risk for confounding due to the use of historical controls, some differences in baseline characteristics and differences in measurements used for intake between the control and intervention groups.

Home and hospital settings

Consistent with previous reviews (24, 25), all the studies reported positive patient and staff experience and satisfaction in both settings. Volunteers were described as helpful, proactive, knowledgeable and essential and possibly enhanced experience by spending longer with patients. However, most of this evidence came from studies at high or unclear risk of bias. Furthermore, the variety and lack of rigorous elements required in the measurement methods and outcome reporting of the qualitative data, made inter-study comparison difficult.

The findings of the present review suggest that trained volunteers are able to carry out a range of tasks autonomously and offer a reliable service. However, a variety of factors may influence a volunteer-delivered intervention including training, age and experience of the volunteer, setting and specific needs of the patient. Whilst we aimed to collate a variety of volunteer-delivered interventions expanded across healthcare and home-based settings, we must also recognize the heterogeneity in the underlying causes of malnutrition and nutritional status among the populations included in the studies where only eight studies reported nutritional status of participants. A variety of screening methods were used also highlighting the lack of agreement on an international screening tool for identifying the risk of malnutrition (58). Nutritional screening is an initial step in the nutrition care process for the

identification of individuals at nutritional risk subsequently allowing for targeted interventions (12). Similarly, the diverse interventions provided by volunteers ranging from food encouragement to meal preparation, targeting different underlying aetiologies in the included participants (e.g. dysphagia or social isolation) makes it difficult to isolate the elements of the intervention that impact outcomes, meaning that “volunteer-driven interventions” remains a ‘black box’.

Very low-quality evidence mainly from studies with overall unclear or high risk of bias suggest volunteer assistance is a safe intervention method. Although some studies reported cost effectiveness associated with volunteers, accepted methods for cost-analysis were not used which precludes any conclusions on cost-effectiveness.

Strengths

A protocol was completed and registered in order to minimise reporting bias. Two authors (JL, MD) compiled a comprehensive list of key terms and searched six databases without any restrictions on language or dates to capture all relevant studies as well as undertaking study selection, data extraction and risk of bias assessments in duplicate. Additional references were identified through snowball searching. The present review built upon previous evidence on trained volunteers in hospital settings and further explored effectiveness in the home setting using additional data from qualitative and recently published studies, and RCTs. Studies that did not clearly report volunteer outcomes specifically were excluded (59, 60). A meta-analysis was carried out which isolated the effect of volunteers in improving mealtime assistance to confirm previous positive findings (26). Additionally, the quality of the overall body of evidence was assessed using the GRADE framework in duplicate.

Limitations

Our review was limited by the variation in reporting of outcomes and hence lack of meta-analyses. Results pooled into the meta-analyses were from a limited number of studies and the use of final means in the meta-analyses may provide an inaccurate estimate of effect due to potential differences in baseline data between studies. An assessment of publication bias using a funnel plot was not possible due to the low number of studies. Grey literature was not explored and authors were not contacted for missing data due to time constraints. All study types were included aimed at considering different interventions in the literature, especially where RCTs may not be possible (61). However, this may have contributed to the low-quality evidence in our review.

Generalisability

The evidence for volunteer interventions in the home setting lacks generalisability to other home settings mainly due to use of convenience samples. The self-recruitment of participants may suggest an overall higher level of motivation, engagement and differences in health. The evidence on hospital interventions lacks confidence due to small samples sizes, variability and bias in methodology and measurement of outcomes due to confounding and lack of use of validated measures.

2. Conclusions

There is currently a lack of good quality evidence on the effectiveness of trained volunteers in the detection and management of malnutrition in adults especially in community settings. This precludes the drawing of firm conclusions. The current paper identified some evidence that trained volunteer interventions may be effective in reducing malnutrition risk in older adults in home and hospital settings. However, the variety of interventions provided by volunteers makes it difficult to determine which interventions are effective in targeting malnutrition risk within different settings. Future research should focus on determining

whether interventions that target specific causes of malnutrition improve defined outcomes in populations at nutritional risk before widespread translation into clinical practice.

Considering the high prevalence and costs of malnutrition, focused research in this area is needed to identify the most efficient use of resources beginning with appropriate nutritional screening and documentation in identification of at risk populations. With current NHS focus on integrating care across different settings, trained volunteers present an opportunity to bridge gaps and add value to the existing workforce.

Due to the ethical implications of RCTs and issues with blinding, adequately powered non-RCTs of robust methodological design may be most appropriate and can provide similarly useful data (61). The likely considerable costs and time investment of staff involved in recruitment, retention, training and provision of support for volunteers necessitate measurement of cost-effectiveness through measures such as QALYs (quality-adjusted life years) (62). In order to understand the context, mechanism and outcomes through which volunteer delivered interventions work, a realist review is recommended (63). This can be especially useful in relation to understanding patient experience of volunteers consistently reported across both settings. It is essential that validated PREMS (Patient reported experience measures) or PROMS (Patient-reported outcome measures) are used in future research to consolidate these findings (64, 65). Given the links between patient experience and improved healthcare outcomes (66), and the latter being one of the key outcomes for the NHS, this may provide future direction to help inform the most cost-effective design and development of volunteer initiatives in malnutrition.

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Table 1: Eligibility criteria based on PICOS

PICOS	Inclusion Criteria
Population	Volunteers: identified as formally recruited and trained personnel in order to reflect a realistic workforce. Adults ≥ 18 years at risk of malnutrition: identified as at risk either within the study or those judged to be at risk by the author including hospitalised patients and patients with conditions such as stroke, cognitive impairment or frailty associated with malnutrition.
Intervention	Any volunteer delivered interventions addressing immediate or underlying causes of malnutrition including mealtime assistance, involvement in schemes such as Meals on Wheels, red tray initiatives or dining companions, dietary advice, nutritional screening or training, home meal delivery, local luncheon clubs, social support and any interventions to promote independence were included.
Control or Comparison	No restrictions were placed on the comparator to include qualitative outcomes on experience and satisfaction.
Outcomes	In order to explore the effect on participants directly, patient centred outcome measures were focused on: Descriptions of types, settings and the modes of nutritional interventions 1. Primary outcomes: Functional outcomes, quality of life, self-management Patient/staff/carer experience and satisfaction e.g. reduction in carer/staff burden 2. Secondary outcomes: Nutritional, clinical/healthcare related, economic outcomes and patient safety Other outcomes: volunteer related outcomes e.g. feasibility, adherence and retention
Studies	All randomised controlled trials (RCTs), non-RCTs, non-intervention and qualitative studies were included to allow realistic exploration of the healthcare environment where funding restrictions, ethical issues and other constraints make blinding and randomisation difficult.

Table 2: Summary of key study characteristics based on intervention setting

Study ID	Study design, location	Duration and follow up	Participant Characteristics	Sample size	Intervention	Volunteer recruitment and training	Comparator	Outcomes
Interventions delivered by volunteers in home settings								
(33) ^a	RCT, Vienna, Austria	12 weeks	83.8% female; mean age: 82.8 (SD: 8.0) years; 52 (65.0%) frail, 27 (33.8%) pre-frail, 1 (1.2%) participant robust; nutritional status (MNA): 38 (47.5%) at risk of malnutrition/malnourished	I: 39 C: 41 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 50 years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	<ul style="list-style-type: none"> • Handgrip strength • Physical performance balance (gait speed, lower limb muscle strength) • Lean body mass • Appendicular skeletal mass
(34) ^a	RCT, Vienna, Austria	12 weeks	84.8% female; mean age: 82.4 (SD: 8.2) years; 38 (65.5%) frail; 19 (32.8%) pre-fail; 1 (1.6%) robust but at risk of malnutrition	I: 34 C: 23 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 50 years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	Inflammatory markers: TNF- α , IL-6, CRP, total leukocytes
(35) ^a	RCT, Vienna, Austria	12 weeks	84% female; mean age: 82.6 (SD: 8.1) years	I: 39 C: 41 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 50 years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	<ul style="list-style-type: none"> • Fear of falling • Physical activity
(36) ^a	RCT, Vienna, Austria	12 weeks	84% female; mean age: 82.6 (SD: 8.1) years; 24 (62%) frail; 14 (36%) pre-frail; 1 (3%) robust	I: 39 C: 41 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 50 years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	Overall QoL: physical health, psychological health, social relationship, environment, sensory abilities, autonomy, past present and future activities, social participation

(37) ^a	RCT, Vienna, Austria	12 weeks	84% female; mean age: 82.8 (SD: 8.0) years; 64% frail; 35% pre-frail; 1% robust; nutritional status (MNA): 51% normal nourished; 45% at risk of malnutrition; 4% malnourished	I: 39 C: 42 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 50 years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	<ul style="list-style-type: none"> • Malnutrition scores (MNA-LF) • Frailty scores • Prevalence of impaired nutritional status Prevalence of frailty
(44)	Pilot, 6 weeks, Canada	6 weeks	86% female; mean age: 82.5 years; no. experiencing problems with ADLs - washing (62%); grooming (55%); meal preparation (66%); > 69% required assistance with grocery shopping; 24% reported receiving help with meal preparation; received Meals on Wheels (14% hot; 17% frozen).	29 Convenience sample	Feasibility of nutrition screening and nutrition education by volunteers under the supervision of dietitians and case managers	30 volunteers; two 3-hours training sessions by dietitian	No control	<ul style="list-style-type: none"> • Participant satisfaction • Volunteer perspectives • Case manager perspectives <i>Other:</i> Inter-rater reliability of nutrition screening tool used by volunteers compared to dietitians
(38)	Parallel randomised control design, B-FU: 8-weeks, Republic of Ireland	8 weeks; F/U: 12 & 26 week	I: Mean age: 75.3 (SD: 7.82; range - 60-91); Nutritional status (MNA): normal 35 (72.9%, at risk 10 (20.8%), malnourished 3 (6.3%); C: Mean age: 74.4 (SD: 7.61; range - 60-89); Nutritional status (MNA): normal 28 (58.3%), at risk 17(35.4%), malnourished 3 (6.3%).	I: 50 C: 50 Convenience sample	Weekly visit from a trained volunteer who prepared and shared a meal with them	Peer volunteers; 55 years; recruited via local social groups, national media, parish and research newsletters; 1 day of training on intervention fidelity, nutritional education (covering the food pyramid, portion size guidelines, tips for healthy eating, tips for maintenance of bone health, bowel health, blood health), culinary skills and interpersonal skills	No volunteer visit; received a guidebook and nutritional and culinary information and advice	<ul style="list-style-type: none"> • Self-efficacy • Food enjoyment • Energy intake

Interventions delivered by volunteers in hospital settings

(48)	Pilot, UK	12 months	Frail, older patients on modified diets, whose swallowing had 'plateaued' and were no longer in acute phase of experiencing swallowing difficulties, needed encouragement with eating, drinking, as well as to be given more time'	Not specified	Dining companions programme; mealtime assistance at lunchtime: helped patients that required more time and needed encouragement with eating and drinking	6 volunteers; Locally recruited nursing students from College; trained by speech and language therapist and dietitian; needs, assistance requirements of ordering meals, safety, when to seek help	No control	Oral intake • Nursing staff reports <i>Other:</i> Rate of nutritional screening
(49)	Observational programme evaluation, U.S.A.	39 months	Mean age: over 65 years; Patients likely to benefit from socialization, required assistance with tray set-up, required prompting to eat, or feeding assistance and did not have dysphagia and were cognitively able to interact with a volunteer	236 observations	Mealtime assistance: assistance with passing out or collecting trays, tray set-up, verbal encouragement and prompting to eat, and feeding the patients	Trained over three sessions by unit coordinator and OT; hand washing and sanitation, adjusting beds and positioning, feeding and other techniques, patient-communication skills	No control	• Potential savings on staff time and cost <i>Other:</i> Tasks completed by the volunteer; Time spent with each patient; Volunteer comments about experience; Adverse events
(22)	Mixed methods, Quasi experimental, UK	15 months	Mean age: over 70 years; nutritional status: median BMI at or above the normal range; most patients at low risk of malnutrition (MUST); significant anorexia among many patients in all departments	8 patients, 7 staff members, 9 volunteers	Mealtime assistance at weekday lunchtime and evening meals: Social interaction, encouragement, preparation, assisting food to mouth, feeding	65 volunteers; 17-77 years; recruitment via hospital's pre-existing voluntary services team; standardised half-day training session delivered by the research team on nutrition in older patients, safe feeding strategies, a practical session on feeding and assessment of competency	No control	• Total cost evaluation of the programme <i>Other:</i> Number of volunteers recruited, trained and their activity; patient, ward staff and volunteers' views on barriers and enablers

(39)	Pilot, Australia	2 months, data collected for 4 days for each patient (2 weekday days with volunteer assistance and 2 days at weekend without)	Mean age: 83 years (SD: 4.5 years) nutritional status (MNA): 7 malnourished; 1 'at risk'; 7 receiving high protein, high energy texture modified diets (3 Puree, 3 Minced, 1 Soft); 1 on a Full diet.	8 patients	Targeted mealtime assistance at lunchtimes: assisting nutritionally 'at risk' patients with feeding, correctly positioning meal trays, cutting up foods, handling cutlery, opening packaging, and encouraging conversation and socialisation	Volunteers trained by dietetics, speech pathology and nursing staff -	Patient acted as their own controls	<ul style="list-style-type: none"> • Macronutrient and energy intakes • Nursing staff and volunteers' views and experiences
(43)	Cross-sectional, Mixed methods design, Australia	2 months, Data collected for 4 days for each patient (2 weekday days with volunteer assistance and 2 days at weekend without)	Mean age: 83.2 years (SD: 8.9); nutritional status: mean BMI 24.3 kg/m ² ; 87% nutritionally compromised (52% at risk; 35% malnourished; MNA); predominantly on a full or soft diet;	23 patients convenience sample	Targeted feeding assistance across 2 wards at lunchtimes: assisting with opening packages, tray set up, feeding, encouragement and other meal related tasks	Volunteers from ongoing volunteer feeding assistance programme; trained via a training programme; feeding patients, encourage higher protein and energy intakes, when to request help	Patients acted as their own controls	<ul style="list-style-type: none"> • Energy and protein intake <p><i>Other:</i> Time with patient, type of assistance carried out by volunteer, patient, nurses and volunteer opinion</p>
(52)	Qualitative, ethnographic approach, Australia	3 months, 67 hours of field work	Patients admitted to subacute ward for geriatric care and rehabilitation	61 staff, volunteers and visitors	Mealtime assistance at lunchtimes	12 volunteers on one subacute ward; trained to encourage and engage patients via conversation and activities, provide mealtime assistance, and completion of other tasks as required by staff	Another subacute ward without volunteers	<ul style="list-style-type: none"> • Perspectives and experiences of volunteer and visitor involvement and interactions at hospital mealtimes • How the volunteer and visitor role is perceived within the hospital system

(51) ^b	Mixed methods evaluation, UK.	1 year	Female acute inpatients; aged ≥ 70 years; not on tube feeds or nil by mouth or end of life	N/A for monitoring of recruitment and training of volunteers; focus groups and interviews: 12 volunteers (convenience sample), 9 patients, 17 nursing staff (purposive sample)	Mealtimes assistance on one acute ward at lunchtimes: feeding two patients, encouraging and assisting another seven, preparing tables and cleaning hands of all nine patients before lunch	Trained in half day sessions 7 times developed by SALT and dietitian; encouragement to eat, cleaning patient hands, support with opening packets, setting up the meal tray, cutting up food, helping guide the food to the patient's mouth and feeding patients	None	<ul style="list-style-type: none"> • Acceptability of training and volunteers' role • Monitoring of volunteers' recruitment, training, activity and retention • Adverse events
(42) ^b	Quasi experimental 2-year pre and post- test study design, UK	2 years (intervention year and non-intervention year)	Female acute inpatients from 4 wards; Mean age ranged from 87.1 (5.3) to 87.9 (SD: 5.1) years Nutritional status: In both years most patients had a BMI within normal range, low MUST score, confusion common - Mean MUST: score 0 ranged from 46 (61.3%) to 63 (70.8%) patients; score 1 ranged from 10 (11.2%) to 12 (13.0%) patients; score ≥ 2 ranged from 16 (18.0%) to 25 (27.8%) patients	I: 221 C: 186	General mealtimes assistance during weekday lunchtimes in 2 acute wards at lunchtimes: specific assistance included (indicated by nursing staff) cleaning hands and trays, encouragement to eat, opening up packages, cutting up food and feeding patients, volunteers offered additional help to other patients	29 volunteers trained in half day sessions 7 times by SALT and dietitian; encouragement to eat, support with opening packets, setting up the meal tray, cutting up food, helping guide the food to the patient's mouth and feeding patients	Historical controls from non-intervention year and parallel control ward in the intervention year - usual care by nursing staff	<ul style="list-style-type: none"> • Energy and protein intake

(46)	Pilot study, U.S.A.	2 months	I: Mean age: 77.8 years C: Mean age: 78.2 years For both groups - 41% of the patients required assistance/encouragement; 59% required total feeding; 29% of patients experienced confusion; 56% experienced generalized weakness; 9% could not use an upper extremity; 5% were too short of breath to complete a meal without help; 1 (3%) patient in each group was blind	I: 34 C: 34	Targeted mealtime assistance 'at each meal': charge nurse helped locate patients requiring assistance	15 college students and 4 current volunteers; 3-hour in-service by interdisciplinary team; information on factors that influence appetite and techniques to improve intake, an experience in which the volunteers fed each other, also taught to estimate and record percentage of tray consumed and record the percentage eaten on the bedside nursing record,	Control: Usual care by nursing staff Matched (age, type of assistance, reason help was required)	<ul style="list-style-type: none"> • Total dietary intake
(41) ^b	Qualitative 1 year before and after intervention, UK	2 years	Female patients from 2 wards; age range - 70 - 90+ years Nutritional status: BMI/Kg/m ² - < 18.5: Ranged from 3 (20%) to 5 (25%) patients; 18.5-24.9: 7 (47%) to 9 (45%) patients; 25-29.9: 3 (20%) to 4 (20%) patients; 30+: 2 (13%) to 2 (10%) patients	19 staff (purposive sample), 25 patients, 5 relatives from each year, 12 volunteers	Mealtime assistance at lunchtimes	Trained in half day sessions 7 times developed by SALT and dietitian; encouragement to eat, cleaning patient hands, support with opening packets, setting up the meal tray, cutting up food, helping guide the food to the patient's mouth and feeding patients	Parallel comparison with a control ward	<ul style="list-style-type: none"> • Perspectives on nutritional care of older inpatients • Acceptability of trained volunteers <i>Other:</i> Elements of their assistance
(50)	Programme Evaluation, UK	April 2010 – August 2011	Patients on wards requiring assistance at mealtimes	Not specified	Mealtime assistance at lunch and supper times	35 volunteers trained during seven 3-hour sessions by SALT and nutrition nurse specialist; best position for eating, the normal swallow, how it feels to be fed by someone else, the type of patients that may require assistance at mealtimes, completing menu cards with patients, how to fill in food and fluid charts	No control	<ul style="list-style-type: none"> • Nursing staff experience • Patient experience <i>Other:</i> Mealtime volunteer experience

(45)	Pilot study, Australia	1 month; Data collected for 4 days for each patient (2 weekday days with volunteer assistance and 2 days at weekend without)	3 males, 6 females from 1 ward; mean age: 89 years (SD: 4.6); patients identified as 'at risk' requiring assistance with feeding, opening packages, encouragement and/ or social support at meal times	9 convenience sample 13 nurses and 14 volunteers provided data on opinions	Targeted feeding assistance during lunch: Patients referred by Nurse Unit Manager and Clinical Care Coordinator	25 volunteers, specifically recruited and trained; encourage high protein, high energy components of the meal first, when to call for nursing assistance	Patients acted as their own control	<ul style="list-style-type: none"> • Average energy and protein intake Opinions of nurses and volunteers about the programme and patient feeding <i>Other:</i> Comparison of average daily energy and protein intakes to average estimated daily requirements
(40)	Observation phase followed by sequential interventions, New Zealand	4 phases of 12-week duration (5-week gap between phases)	<p>Older people with cognitive impairment in a short stay unit</p> <p>I (phase 3): 5 males, 2 females; mean age: 77.0 (SD: 6.5) years; nutritional status: BMI/Kg/m²: 24.3 (SD 3.5); MNA (scores of < 9 indicate malnutrition): 8.6 (3.3)</p> <p>C (phase 1): 12 males, 11 females; mean age 80.0 (SD: 7.9); nutritional status: BMI/Kg/m²: 23.9 (SD: 3.7); MNA: not available</p>	I: (Phase 3) - 7 C: (Phase 1) - 23	<p>Phase 1: Observation; Phase 2: Encouraging dietary, 'Grazing'; Phase 3: Volunteer assistance at lunchtimes to maximise food and fluid intake by assisting semi-independent eaters and freeing staff to assist more specialist patients; Phase 4: Improving dining room ambience by playing soothing music.</p>	No information	Patients observed during the observation phase	<ul style="list-style-type: none"> • BMI • Mid arm circumference Caloric intake

(47)	Prospective observational trial design for intervention with a retrospective control group, UK	I: collected August to December 2005 C: collected May to September 2003	Dysphagic older patients on a texture modified diet and/or thickened fluids + no family/carer available to help at mealtimes I - 44% female; Mean age 76.1 (SD: 11.2) years; mean weight 55.9Kg (SD: 19.5) C - 48% female; mean age 81.8 (SD: 8.7) years; mean weight 59.9Kg (SD: 14.3) No significant differences between the two groups for age, gender distribution or type of diet; difference in weight was of borderline significant and there were clear differences in supervision level	I: 16 C: 30	Targeted mealtime assistance: each patient was assisted for 3 days between the period of 08.00–16.00h to include breakfast and lunch and in between meal snacks and supplements.	1-week training programme by an experienced dietitian and SALT on targeted assistance	No mealtime assistance	Energy and protein intake
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^a Same cohort of same study; ^b Partly same cohort of same study; I - intervention group; C - control group; SD - standard deviation; BMI - body mass index; MNA - Mini Nutritional Assessment; MUST - Malnutrition Universal Screening Tool; CRP - C-reactive protein; IL-6 - interleukin 6; TNF- α - tumour necrosis factor- α ; SALT – speech and language therapist; ADL – activities of daily living

Table 3: Summary of outcomes data from studies reporting on functional outcomes and quality of life

Functional outcome	Study ID	Sample Size (n)	Methods	Results			
				Within group MD (95% CI)	P value	Between group MD (95% CI)	P value
Handgrip strength/Kg	(33)	I:39 C:41	Hydraulic hand dynamometer (67)	I: 2.4 (1.0 to 3.8) C: 0.8 (-0.4 to 2.0)	0.001 0.189	1.3 (-0.3 to 2.9)	0.105
Overall Physical performance (SPPB)	(33)	I:39 C:41	Short Physical Performance Battery (68)	I: 1.2 (0.3 to 2.1) C: 0.5 (0.1 to 0.9)	0.009 0.011	1.0 (0.0 to 2.0)	0.044
Balance					<0.001 0.002	0.0 (-0.5 to 0.4)	0.934
Gait speed				I: 0.4 (0.0 to 0.8) C: 0.5 (0.2 to 0.8)	0.316 0.688	0.2 (-0.2 to 0.7) 0.6 (0.2 to 1.1)	0.231
Lower limb muscle strength				I: 0.2 (-0.2 to 0.6) C: -0.1 (-0.3 to 0.2) I: 0.6 (0.2 to 1.0) C: 0.1 (-0.2 to 0.3)	0.003 0.464		0.007
Physical activity scale	(33)	I:39 C:41	Physical Activity Scale (69)	I: 17.1 (24) ^a C: 1.9 (18.6) ^a	<0.001 N.S.	15.20 (5.76 to 24.64)	<0.001
Frailty scale	(36)	I:39 C:41	SHARE-FI scale (70)	I: -0.71 ^b (-1.07 to -0.35) C: -0.35 ^b (-0.66 to -0.44)	<0.001 0.027	-0.30 (-0.75 to 0.15)	0.187
Frailty prevalence				I: 0.45 ^b (0.23 to 0.86) C: 0.53 ^b (0.26 to 1.08)	0.014 0.079	0.80 (0.33 to 1.99)	0.635
Fear of falling scale	(35)	I:39 C:41	Falls Efficacy Scale – International (71)	I: 4.2 (7.36) ^a C: 0.1 (0.32) ^a	<0.001 0.016	4.10 (1.79 to 6.41)	0.016
Self-efficacy scale	(38)	I:50 C:50	Validated General Self-Efficacy scale	I: 0.14 (0.165) ^a C: 0.12 (0.14) ^a		0.02 (-0.04 to 0.08)	0.054
Overall Quality of life scale MD (95% CI)	(36)	I:39 C:41	WHOQOL-BREF (72) and WHOQOL-OLD (73).	I: 5.6 (0.95 to 10.33) C: 2.5 (-1.66 to 6.54)	<0.05 N.S.	3.16 (-2.59 to 8.91) 3.66 (0.13 to 7.18)	0.277 0.039
Past, present and future activities				I: 4.7 (1.99 to 7.42) C: -0.1 (-3.23 to 2.95)			

I - intervention; C - control; MD - mean difference; CI - confidence interval; SD - standard deviation; OR – odds ratio; N.S- not statistically significant; WHOQOL- BREF – World Health Organisation Quality of Life Brief version; WHOQOL- OLD – World Health Organisation Quality of Life Older people; ^a SD; ^b OR

Table 4: Summary of findings on patient and staff satisfaction and experience with the intervention program according to type of setting

Study ID	Methods and sample size	Outcomes related to patient/staff/carer/family experience and/or satisfaction
(38)	Validated food enjoyment questionnaire (74) I: 50, C: 50	Intervention group improved their food enjoyment over time more than control group Intervention group showed significant improvements for food enjoyment relative to controls
(44)	Satisfaction questionnaire; no information whether it was validated I: 29 No control	Participating clients: 100% satisfied with their relationships with the nutrition volunteers 83% felt volunteers were knowledgeable about nutrition 86% felt they had provided useful information 86% very satisfied with the length of contact 90% appreciated nutrition volunteers arranging services for them All felt intervention was worthwhile service (one exception) Case managers: 71% felt their clientele could benefit from intervention 73% felt the older adult nutrition volunteers were well suited to carry out nutrition screening 91% felt they were well suited to deliver nutrition education 1/3 believed nutrition volunteers should develop intervention plans 83% were satisfied with how the intervention was implemented 72% felt intervention could be integrated into their ongoing practice
(48)	Not reported	Nursing staff report: improved patient care and felt supported to maintain protected mealtimes, record food intake and had a greater awareness of nutritional care
(49)	236 observations	Volunteers spent average of 47.8 minutes per patient
(22)	Semi-structured interviews by 1 researcher; purposive sample of 8 patients, 7 staff members, 9 volunteers	Patients and staff: universally valued the volunteers and felt they were skilled at encouraging reluctant eaters
(43)	Observations of mealtime environments, patient interviews, nurse and volunteer surveys I: 23, C: 23	Patient interviews: found volunteers “encouraging” “wonderful” “helpful” Nurses: all were positive about the program and considered it to be effective, helpful and essential Volunteers: spent an average of 12.3 minutes per patient compared to 4.7 minutes by nurses
(51)*	Interviews and focus groups; 12 volunteers, 9 patients, 17 nursing staff	Nursing staff: felt the service “runs more smoothly. Because we’ve got more support from the mealtime assistant, we can do a lot more” Patients and ward staff: valued the volunteer contribution Patients: felt the intervention was “very good” found the volunteers helpful and expressed that regular volunteers present the opportunity to develop “good relationship”
(46)	Patient, family and staff experience; method not reported I: 34, C: 34	Nursing staff, patients, and family members: expressed much satisfaction and appreciation of the service Improved intake was influenced by both the knowledge and sensitivity of caring volunteers Volunteers applied specific dysphagia related knowledge learnt during training

(50)	Patient and nursing staff experience; method and sample size not reported	<p>Nurses: Gave positive feedback about mealtime volunteers. Several wards with more experienced volunteers have expanded their roles, for example, they now write out menu cards, including those with dietary requirements. Nurses have found they are not required to assist at all with menu selections when the volunteers are in. Mealtime volunteers help with the quick, efficient delivery of meals, freeing up time so the nursing team can assist those in need physical or verbal encouragement to eat.</p> <p>Patients: Main benefit of mealtime volunteers was the chance to “have a chat”. The volunteer was someone who was there to help them at mealtimes but, because they were not in uniform, they were seen as being less busy than the nurses. Longer-stay patients looked forward to the days when the mealtime volunteers came in. One patient said she not only looked forward to them coming in, but also that their presence helped her try harder to eat more to get well.</p>
(45)	Overt observations of main meal with volunteers, patients and staff; Patients were asked about their mid meal intakes and appetite; 13 nurses and 10 volunteers surveys	<p>Nurses: all reported the volunteer feeding assistance program to be of value on the ward 54% of them expressed concern about a lack of time or staffing resources at meal times and a desire for the volunteer program to be extended to other meals Volunteers more likely to socialise, encourage and spend longer with patients</p>
(52)	Mealtime observations; 61 staff, volunteers and visitors interviewed in 75 ethnographic and semi-structured interviews; data inductively and thematically analysed	<p>Key theme related to volunteers: ‘Help’ – volunteers and visitors were considered helpful</p> <p>Nurses: volunteers assisted at mealtimes by helping patients, supervising those eating their meal in the dining room, proactive when working with foodservice staff, assisting with communication by updating communication boards in patient rooms</p>
(41)*	Semi-structured interviews and focus groups in baseline and intervention years; purposively sampled 19 nursing staff, 25 patients, 5 relatives, 12 volunteers; data collected by one researcher, digitally recorded and thematically analysed	<p>Before the intervention: Staff: felt under pressure with insufficient people assisting at mealtimes After volunteers were introduced: Staff and patients: volunteers improve quality of mealtime care, viewed as extra pairs of hands to support patients needing more straightforward help, enabling nurses to feed patients with swallowing difficulties and be available for other care</p>

*Partly same cohort from the same study

Table 5 : Summary of findings for the main outcomes

Outcome	Participants (number of studies)	Quality of evidence (GRADE)	Volunteer intervention Vs usual care, MD (95% CI)
Functional outcomes Overall Physical Performance (score)	80 (1)	++ Low quality ^{1,2}	Favoured volunteer intervention 1.0 (0.0 to 2.0)
Balance (score)	80 (1)	++ Low quality ^{1,2}	1.0 (-0.5 to 0.4)
Gait speed (score)	80 (1)	++ Low quality ^{1,2}	0.2 (-0.2 to 0.7)
Lower limb muscle strength (score)	80 (1)	++ Low quality ^{1,2}	Favoured volunteer intervention 0.6 (0.2 to 1.1)
Physical activity	80 (1)	++ Low quality ^{1,2}	Favoured volunteer intervention 15.20 (5.76 to 24.64)
Fear of falling	80 (1)	++ Low quality ^{1,2}	Favoured volunteer intervention 4.10 (1.79 to 6.41)
Handgrip strength	80 (1)	++ Low quality ^{1,2}	1.3 (-0.3 to 2.9)
Frailty	80 (1)	++ Low quality ^{1,2}	-0.30 (-0.75 to 0.15)
Self-efficacy	100 (1)	+ Very low quality ^{1,2,3}	Not estimable
Overall QoL	80 (1)	++ Low quality ^{1,2}	3.16 (-2.59 to 8.91)
Patient satisfaction	129 (2)	+ Very low ^{1,3}	One study reported a significant effect of volunteers on subjects' food enjoyment using a validated questionnaire. The other study did not assess statistical significance, and did not specify whether the questionnaire used was validated but noted satisfaction rate of >80% for most items
Patient experience	Not specified (9)	+ Very low ³	All studies reported a positive experience but most were at high or unclear risk of bias
Nutritional Intake Total energy	56 (4)	+ Very low ^{1,3}	870.93 [-269.92, 2011.79]
Lunchtime energy	40 (3)	+ Very low ^{1,3}	Favoured volunteer intervention 378.15 [20.57 to 735.72]
Nutritional status			
BMI (Kg/m²)	30 (1)	+ Very low ^{1,3,4}	Not estimable
Mid arm circumference	7 (1)	+ Very low ^{1,3,4}	Not estimable

Lean body mass	80 (1)	++ Low ^{1,2}	-0.4 (-1.7 to 1.0)
Skeletal muscle mass	80 (1)	++ Low ^{1,2}	0.1 (-0.5 to 0.6)
Malnutrition score	80 (1)	++ Low ^{1,2}	0.27 (1.13 to 1.67)
Malnutrition prevalence	57 (1)	++ Low ^{1,2}	1.26 (0.57 to 2.76)
Inflammatory markers			
TNF-α			
IL-6			
Total leukocytes	57 (1)	Very low ^{1,2,5}	Not estimable
CRP			
Cost	236 observations (1 evaluation project)	+ Very low ³	One study noted cost savings but did not take into account cost of training. The other study reported cost saving and took training and admin costs into account but did not undertake a cost-effectiveness analysis.
	Number not specified (1 feasibility study)		
Patient safety	188 (4), Not specified (1 evaluation project: 236 observations)	+ Very low ³	None of the studies reported adverse events related to volunteers.

Abbreviations: MD - Mean difference; CI - confidence interval; QoL - quality of life; BMI - body mass index; TNF- α - tumour necrosis factor- α ; IL-6 - interleukin 6; CRP - C-reactive protein

Grade (Grading of Recommendations Assessment, Development and Evaluation) Working Group grades of evidence (29)

High Quality: Further research is very unlikely to change our confidence in the estimate of effects

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate

Low Quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate

Very low quality: We are very uncertain about the estimate

1 - Small number of studies with small sample sizes

2 - indirectness due to use of convenience sample in RCT

3 - evidence mainly from studies with unclear or high risk of bias for several domains

4 - design and methodological limitations (no/poorly matched control)

5 - inconsistency

Figure 1: Study selection process

Figure 2: Risk of bias summary table: Judgements of review on study quality based on Cochrane Collaboration's Risk of bias tool, ROBINS-I and CASP checklist.
Key: + low risk; - high risk; ? unclear risk of bias (Review Manager v5.3)

Figure 1: Meta-analysis of the effects of volunteer mealtime assistance on mean total energy (KJ) and mean lunchtime energy (KJ) intakes among hospitalised patients